

Technical Memorandum

Date: May 3, 2022
To: Ohio EPA
From: David L. Elam, Jr.
Project: 483262.0000
Subject: Material Balance Calculations for Ammonia, Dovetail Energy Lagoon, Fairborn, OH, updated to, to correct a data entry error in the April 7, 2022 report, to clarify the use of lagoon, and to include April 4, 2022 sample results, an example calculation, and laboratory reports,

TRC Environmental Corporation (TRC) was asked to calculate potential ammonia (NH_3) atmospheric emissions from the lagoon at the Dovetail Energy Facility (Dovetail) using a material balance approach. This brief memo provides an overview of the process, the material balance approach, and the results of the material balance calculations. This approach assumes that changes in the total ammoniacal nitrogen (TAN) inventory are due to the volatilization of NH_3 from the lagoon surface.

Process Description: Dovetail receives hog manure and food wastes and mixes them in proportions that vary based on digester chemistry needs. The mixed slurry is then transferred to an adjacent anaerobic digester for the production of biogas which is burned on site to generate electricity. Digestate is discharged from the digester to a tank which has been identified as a lagoon on sample chain of custody forms and lab reports. For consistency with lab reports, this technical memo refers to the tank as the lagoon. The digestate is subsequently removed periodically for land application to amend agricultural land. Over time, the discharge volume from the digester is roughly equal to the volume of slurry that is supplied to it.

Dovetail collects process data including food waste dosing in gallons, hog waste dosing in tons (which is converted to gallons using a conversion factor of 7.8 pounds per gallon), and digestate removed for land application in gallons. Dovetail also collects a variety of analytical data to manage digester chemistry.

Digestate samples are collected periodically from the digester recirculation loop for process monitoring and analyzed for a variety of parameters including pH, total ammoniacal nitrogen (TAN), and total Kjeldahl nitrogen (TKN). The TAN concentration represents the sum of both the ammonia (NH_3) and ammonium (NH_4^+) forms of ammonia. Samples from the recirculation loop are representative of the material that is discharged from the digester to the lagoon. To conduct the material balance, TRC requested that Dovetail collect samples from the lagoon, distant from the pipe from the digester that discharges into the lagoon. The lagoon samples are representative of the digestate that is removed for land application.

Mass Balance Approach: TRC's approach to the mass balance calculations is outlined below:

1. Food waste and hog manure volumes supplied to the digester were recorded daily from March 1, 2022 through April 4, 2022.
2. For the purposes of this preliminary mass balance calculation, the digester feed volume was set equal to the volume removed for land application. In practice, digestate accumulates in the lagoon and is removed periodically.
3. Grab samples were collected from the recirculation loop and lagoon on March 14, 2022, March 21, 2022, March 28, 2022, and April 4, 2022 and analyzed for TAN, TKN, nitrate nitrogen, pH, phosphorous, specific gravity, total solids, and potassium. Material balance calculations were performed for TAN and TKN. The lab reported TAN and TKN concentrations in percent nitrogen (N) which were converted to milligrams per liter (mg/l) by multiplying the reported value by 10,000 (1% = 10,000 ppm = 10,000 mg/l). No adjustments were made for specific gravity because the specific gravity values were very close to 1 gram per milliliter (g/ml).
4. The total dosing volume in gallons was converted to liters using 3.785 liters per gallons.
5. The daily masses of TAN and TKN were calculated by multiplying the concentration in mg/liters by the dosing volume in liters for either the 14-, 21-, 28, or 35-day interval. The resulting value in mg was converted to pounds (lb) using conversion factors of 1,000 mg/g and 454 g/lb. The daily mass was calculated by dividing the total by 14, 21, or 28, as appropriate.
6. Potential emissions, as N, were calculated by subtracting the per day total mass of TAN calculated for the lagoon from the per day total mass of TAN calculated for the recirculation loop. Differences are reported to the nearest tenth while daily values have been reported to the nearest whole number.
7. Potential emissions, as NH_3 , were calculated by multiplying emissions as N by the ratio of the molecular weight of NH_3 (17 grams/mole) to that of (14 grams/mole), which is 1.214.
8. An example material balance for the March 1-14, 2022 period sample calculation is provided on page 3.
9. Laboratory reports are provided in Attachment A.

Results: Mass balance calculation results are presented in Tables 1-8 on pages 4-11, respectively. Shaded cells represent sample collection dates.

Example Material Balance Calculations

$$\text{Period Total Food Waste (Gallons)} = \sum [\text{March 1 to March 14 (Dosing Gallons/day)}] = 92,407 \text{ Gallons}$$

$$\begin{aligned} \text{Period Total Food Waste (Liters)} &= 92,407 \text{ Total Food Waste (Gallons)} \times 3.785 \frac{\text{Liters}}{\text{Gallon}} \\ &= 349,760 \text{ Liters Food Waste} \end{aligned}$$

Same Equations Used for Hog Waste Dosing

Example Calculations, Table 2:

$$\text{Recirculation Loop (mg N/Liter)} = 0.2797\% \times \frac{1,000,000 \text{ ppm}}{100\%} = 2797 \text{ ppm} \times \frac{1 \text{ mg/Liter}}{1 \text{ ppm}} = 2797 \text{ mg/Liter}$$

$$\text{lb of N} = 2797 \frac{\text{mg}}{\text{Liter}} \times 3.785 \frac{\text{Liter}}{\text{Gallon}} \times 92,407 \text{ Gallons} \times \frac{1}{1000 \frac{\text{mg}}{\text{g}} \times 454 \text{ g/lb}} = 3256 \text{ lb of N}$$

$$\text{Average lb of N per day} = \frac{3260 \text{ lb}}{14 \text{ days}} = 233 \frac{\text{lb}}{\text{day}} \text{ N}$$

Same Equations used for Lagoon

$$\text{Potential Emissions per Day as N} = 233 \frac{\text{lb}}{\text{day}} \text{ Recirculation} - 214 \frac{\text{lb}}{\text{day}} \text{ Lagoon} = 18.6 \frac{\text{lb}}{\text{day}} \text{ as N}$$

$$\text{Potential Emissions per Day as NH}_3 = 18.3 \frac{\text{lb}}{\text{day}} \text{ as N} \times \frac{17 \frac{\text{g}}{\text{mole}} \text{ NH}_3}{14 \frac{\text{g}}{\text{mole}} \text{ N}} = 22.6 \frac{\text{lb}}{\text{day}} \text{ as NH}_3$$

Table 1. Food Waste and Hog Manure Dosing Volumes, March 1-14, 2022			
Date	Food Waste Dosing, Gallons	Hog Waste Dosing, Gallons	Total Dosing, Gallons
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
Period Total, gallons	92,407	47,368	139,775
Period Total, liters	349,760	179,289	529,050

Table 2. TAN and TKN Mass Balance Calculations, March 1-14, 2022					
	TAN, mg N/l	TKN, mg N/l	Notes	TAN, lb of N	TKN, lb of N
Recirculation Loop					
March 14, 2022	2,797	3,150	pH = 8.1		
Average¹	2,797	3,150	Period Total	3,256	3,671
			Per Day Total	233	262
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
Average¹	2,574	3,190	Period Total	3,000	3,717
			Per Day Total	214	266
Difference			Per Day	18.6	-3.3
Potential Emissions, as N			Per Day	18.6	---
Potential Emissions, as NH₃			Per Day	22.6	---
¹ There is only one value for the average calculation.					

Table 3. Food Waste and Hog Manure Dosing Volumes, March 1-21, 2022			
Date	Food Waste Dosing, Gallons	Hog Waste Dosing, Gallons	Total Dosing, Gallons
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
3/15/2022	5,614	5,263	10,877
3/16/2022	5,732	5,263	10,995
3/17/2022	6,025	5,263	11,288
3/18/2022	6,515	5,263	11,778
3/19/2022	6,500	0	6,500
3/20/2022	6,500	0	6,500
3/21/2022	6,500	5,263	11,763
Period Total, gallons	135,793	73,684	209,477
Period Total, liters	513,977	278,895	792,871

Table 4. TAN and TKN Mass Balance Calculations, March 1-21, 2022					
	TAN, mg N/l	TKN, mg N/l	Notes	TAN, lb of N	TKN, lb of N
Recirculation Loop					
March 14, 2022	2,797	3,150	pH = 8.1		
March 21, 2022	2,726	2,800	pH = 7.96		
Average	2,760	2,975	Period Total	4,823	5,196
			Per Day Total	230	247
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
March 21, 2022	2,205	2,770	pH = 6.06		
Average	2,390	2,980	Period Total	4,173	5,204
			Per Day Total	199	248
Difference			Per Day	30.8	-0.4
Potential Emissions, as N			Per Day	331.0	---
Potential Emissions, as NH₃			Per Day	37.6	---

Table 5. Food Waste and Hog Manure Dosing Volumes, March 1-28, 2022			
Date	Food Waste Dosing, Gallons	Hog Waste Dosing, Gallons	Total Dosing, Gallons
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
3/15/2022	5,614	5,263	10,877
3/16/2022	5,732	5,263	10,995
3/17/2022	6,025	5,263	11,288
3/18/2022	6,515	5,263	11,778
3/19/2022	6,500	0	6,500
3/20/2022	6,500	0	6,500
3/21/2022	6,500	5,263	11,763
3/22/2022	6,617	0	6,617
3/23/2022	6,423	5,263	11,686
3/24/2022	7,150	5,263	12,413
3/25/2022	7,221	5,263	12,484
3/26/2022	7,500	0	7,500
3/27/2022	7,500	0	7,500
3/28/2022	7,500	5,263	12,763
Period Total, gallons	185,704	94,737	280,441
Period Total, liters	702,890	358,579	1,061,469

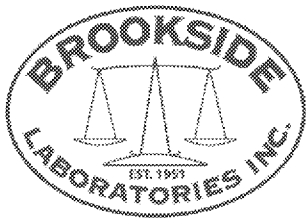
Table 6. TAN and TKN Mass Balance Calculations, March 1-28, 2022					
	TAN, mg/L	TKN, mg/L		TAN, lb of N	TKN, lb of N
Recirculation Loop					
March 14, 2022	2,797	3,150	pH = 8.1		
March 21, 2022	2,726	2,800	pH = 7.96		
March 28, 2022	2,969	3,310	pH = 8.23		
Average	2,830	3,087	Period Total	6,619	7,217
			Per Day Total	236	258
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
March 21, 2022	2,205	2,770	pH = 6.06		
March 28, 2022	2,932	2,800	pH = 6.18		
Average	2,570	2,920	Period Total	6,010	6,827
			Per Day Total	215	244
Difference			Per Day	21.8	13.9
Potential Emissions, as N			Per Day	21.8	---
Potential Emissions, as NH ₃			Per Day	26.4	---

Table 7. Food Waste and Hog Manure Dosing Volumes, March 1, 2022 – April 4, 2022			
Date	Food Waste Dosing, Gallons	Hog Waste Dosing, Gallons	Total Dosing, Gallons
3/1/2022	5,251	5,263	10,514
3/2/2022	5,699	5,263	10,962
3/3/2022	6,500	0	6,500
3/4/2022	7,215	5,263	12,478
3/5/2022	8,169	0	8,169
3/6/2022	8,349	0	8,349
3/7/2022	8,568	5,263	13,831
3/8/2022	8,431	5,263	13,694
3/9/2022	5,679	5,263	10,942
3/10/2022	5,714	5,263	10,977
3/11/2022	5,732	5,263	10,995
3/12/2022	5,700	0	5,700
3/13/2022	5,700	0	5,700
3/14/2022	5,700	5,263	10,963
3/15/2022	5,614	5,263	10,877
3/16/2022	5,732	5,263	10,995
3/17/2022	6,025	5,263	11,288
3/18/2022	6,515	5,263	11,778
3/19/2022	6,500	0	6,500
3/20/2022	6,500	0	6,500
3/21/2022	6,500	5,263	11,763
3/22/2022	6,617	0	6,617
3/23/2022	6,423	5,263	11,686
3/24/2022	7,150	5,263	12,413
3/25/2022	7,221	5,263	12,484
3/26/2022	7,500	0	7,500
3/27/2022	7,500	0	7,500
3/28/2022	7,500	5,263	12,763
3/29/2022	8,216	5,263	13,479
3/30/2022	9,126	5,263	14,389
3/31/2022	9,415	5,263	14,678
4/1/2022	9,512	5,263	14,775
4/2/2022	9,500	0	9,500
4/3/2022	9,500	0	9,500
4/4/2022	9,500	5,263	14,763
Period Total, gallons	250,473	121,053	371,526
Period Total, liters	948,040	458,184	1,406,225

Table 8. TAN and TKN Mass Balance Calculations, March 1, 2022 – April 4, 2022					
	TAN, mg/L	TKN, mg/L		TAN, lb of N	TKN, lb of N
Recirculation Loop					
March 14, 2022	2,794	3,150	pH = 8.1		
March 21, 2022	2,726	2,800	pH = 7.96		
March 28, 2022	2,969	3,310	pH = 8.23		
April 4, 2022	2,650	2,920	pH = 6.32		
Average	2,785	3,045	Period Total	8,6268	9.432
			Per Day Total	247	269
Lagoon, 14' Deep					
March 14, 2022	2,574	3,190	pH = 6.3		
March 21, 2022	2,205	2,770	pH = 6.06		
March 28, 2022	2,932	2,800	pH = 6.18		
April 4, 2022	2,070	2,070	pH = 7.89		
Average	2,445	2,708	Period Total	7,574	8,386
			Per Day Total	216	240
Difference					
			Per Day	30	29.9
Potential Emissions, as N					
Potential Emissions, as NH ₃			Per Day	30.1	---
			Per Day	36.6	---

Attachment A: Laboratory Reports

Note that lab reports use “Discharge” for what has been identified in this memo as the “Recirculation Loop.” The sample collection date is missing on the April 6, 2022 report. Asura Associates contacted Renergy and confirmed the April 4, 2022 collection date.



Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/14/2022
Date Received: 03/15/2022

Lab Number: ZE0315021
Location: LAGOON
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed</u>		<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
				<u>Prep</u>	<u>Anal</u>			
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-17	NLS	0.257403 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-16	BAT	0.00013 %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-17	jk	0.319 %	0.01
IA590	pH		4500H-B		Mar-15	LMP	6.3 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-16	Mar-17	ALP	643.4 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-17	LMP	.9984425 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-18	LMP	3.552 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-16	Mar-17	ALP	497.45 mg/l	5

Approval

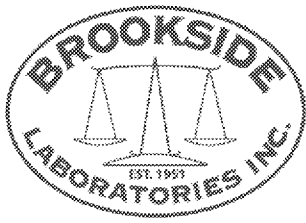
Erica Huber
Environmental Laboratory Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

LOQ = Limit of Quantitation (The lowest concentration of analyte in a sample that can be determined with acceptable precision and accuracy under the stated experimental conditions.)

Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.



Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/14/2022
Date Received: 03/15/2022

Lab Number: ZE0315022
Location: DISCHARGE
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed Prep</u>	<u>Anal</u>	<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-17	NLS	0.279747 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-16	BAT	0.00035 %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-17	jk	0.315 %	0.01
IA590	pH		4500H-B		Mar-15	LMP	8.1 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-16	Mar-17	ALP	907.15 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-17	LMP	1.002806 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-18	LMP	2.598 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-16	Mar-17	ALP	667.25 mg/l	5

Approval

Erica Huber
Environmental Laboratory Manager

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FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide TestsDate Submitted: 3/14/2022 Client #: 58251(w1702) # Samples Submitted 2Client Name: Dovetail Bio Energy Consultant: Shane EagleAddress: PO Box 249 Delaware, OH 43015 Sampled By: Shane Eagle

Office Use

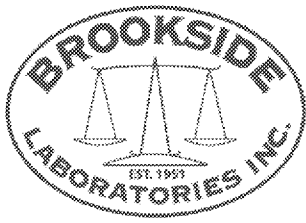
Form #: _____ Due Date: _____
No. Samples Rec'd: 3-18-22
Date Rec'd: _____
Rec'd By: _____Check box if data is to be: ☐ Fax # _____ ☒ e-mail: (address) dave.ellis@azuraassociates.com

Soil Audit Format:	ppm: <input type="checkbox"/> yes <input type="checkbox"/> no		Report unit: pick one: <input type="checkbox"/> lb/ac <input type="checkbox"/> lbs/1000 sq. ft. <input type="checkbox"/> kg/ha		Sample Depth: <input type="checkbox"/> inches <input type="checkbox"/> cm					
(16 Characters ea.)	Sample 1 (8 characters ea.)		Sample 2 (8 characters ea.)		Sample 3 (8 characters ea.)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea.)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Lagoon			ZE0315021							
Discharge			ZE0315022							

Please check desired package (Soil): ☐ S001 ☐ S001P ☐ S001A ☐ S001B ☐ S001C ☐ S110 ☐ S113 ☐ S001N ☐ S001AN ☐ S001BN ☐ S001CN☐ S001PN ☐ S002 ☐ S003 ☐ S004 ☐ S004LM ☐ S005 ☐ S006 ☐ S006W=client H2O ☐ S007 ☐ S015 ☐ S015N ☐ S019 ☐ S008 ☐ S009 ☐ S009LM☐ S010 ☐ S011 ☐ S017 ☐ S171 ☐ S180 ☐ S251 (Manure, Fert., Lime): ☐ Z001 ☐ Z002 ☐ Z003 ☐ Z004 ☐ X001 ☐ X002 ☐ X003 ☐ L001 ☐ L002☒ Other EE260

If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.)

3 Day turn around



Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/21/2022
Date Received: 03/22/2022

Lab Number: ZE0322003
Location: LAGOON
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed Prep</u>	<u>Anal</u>	<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-24	NLS	0.220505 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-24	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-25	JK	0.277 %	0.01
IA590	pH		4500H-B		Mar-22	ALP	6.06 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-23	Mar-25	LMP	710.6 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-22	ALP	.9894607 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-22	ALP	3.88 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-23	Mar-25	LMP	449.55 mg/l	5

Approval



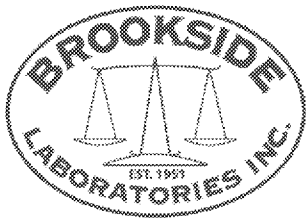
Erica Huber
Environmental Laboratory Manager

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Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/21/2022
Date Received: 03/22/2022

Lab Number: ZE0322004
Location: DISCHARGE
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed Prep</u>	<u>Anal</u>	<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-24	NLS	0.2726 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-24	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-25	JK	0.28 %	0.01
IA590	pH		4500H-B		Mar-22	ALP	7.96 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-23	Mar-25	LMP	999.45 mg/l	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-22	ALP	1.004552 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-22	ALP	2.722 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-23	Mar-25	LMP	675.6 mg/l	5

Approval



Erica Huber
Environmental Laboratory Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

LOQ = Limit of Quantitation (The lowest concentration of analyte in a sample that can be determined with acceptable precision and accuracy under the stated experimental conditions.)

Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

58251
AEM

FR0691

FIELD WORKSHEET

For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests

Date Submitted: 3/21/22 Client #: 58251-289 # Samples Submitted 2

Client Name: Renergy Consultant: R.O.

Address: PO Box 249 Delaware, OH 43015 Sampled By: R.O.

Office Use

Form #: Due Date:
No. Samples Rec'd:
Date Rec'd:
Rec'd By:

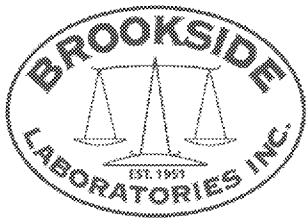
Check box if data is to be: ☐ Fax #

☐ e-mail: (address) Froberfield@renergy.com

Soil Audit Format:	ppm: <input type="checkbox"/> yes <input type="checkbox"/> no		Report unit: pick one: <input type="checkbox"/> lb/ac <input type="checkbox"/> lbs/1000 sq. ft. <input type="checkbox"/> kg/ha		Sample Depth: <input type="checkbox"/> inches <input type="checkbox"/> cm					
(16 Characters ea.)	Sample 1 (8 characters ea.)		Sample 2 (8 characters ea.)		Sample 3 (8 characters ea.)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea.)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
EMD DP Discharge 3/21/22			ZE03	23025						
EMD Lagoon NEL 3/21/22			ZE03	23026						

Please check desired package (Soil): ☐ S001 ☐ S001P ☐ S001A ☐ S001B ☐ S001C ☐ S110 ☐ S113 ☐ S001N ☐ S001AN ☐ S001BN ☐ S001CN
☐ S001PN ☐ S002 ☐ S003 ☐ S004 ☐ S004LM ☐ S005 ☐ S006 ☐ S006W=client H2O ☐ S007 ☐ S015 ☐ S015N ☐ S019 ☐ S008 ☐ S009 ☐ S009LM
☐ S010 ☐ S011 ☐ S017 ☐ S171 ☐ S180 ☐ S251 (Manure, Fert., Lime): ☐ Z001 ☐ Z002 ☐ Z003 ☐ Z004 ☐ X001 ☐ X002 ☐ X003 ☐ L001 ☐ L002
☒ Other: ~~XXXXXXXXXX~~ EE 260 If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.)

~~XXXXXXXXXX~~ 3 day turn around



Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/28/2022
Date Received: 03/29/2022

Lab Number: ZE0329014
Location: LAGOON
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed Prep</u>	<u>Anal</u>	<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-30	NLS	0.293186 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-31	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-30	JK	0.28 %	0.01
IA590	pH		4500H-B		Mar-31	ALP	6.18 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-29	Mar-30	LMP	431.5 mg/kg	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-30	ALP	1.016814 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-30	ALP	1.809 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-29	Mar-30	LMP	405.55 mg/kg	5

Approval

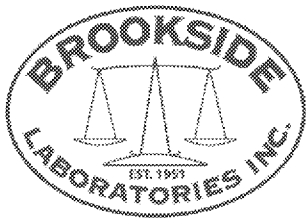
Erica Huber
Environmental & Geotechnical Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

LOQ = Limit of Quantitation (The lowest concentration of analyte in a sample that can be determined with acceptable precision and accuracy under the stated experimental conditions.)

Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.



Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected: 03/28/2022
Date Received: 03/29/2022

Lab Number: ZE0329015
Location: DISCHARGE
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed Prep</u>	<u>Anal</u>	<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Mar-30	NLS	0.2969 %	0.01
IA490	NITROGEN-NITRATE		300.0		Mar-31	BAT	0.00025 %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Mar-30	JK	0.331 %	0.01
IA590	pH		4500H-B		Mar-31	ALP	8.23 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Mar-29	Mar-31	LMP	1032.1 mg/kg	100
IA710	SPECIFIC GRAVITY		SM 2710 F		Mar-30	ALP	1.022897 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Mar-30	ALP	2.689 %	0.01
IB200	POTASSIUM	3050B	6010C	Mar-29	Mar-31	LMP	590.2 mg/kg	5

Approval

Erica Huber
Environmental & Geotechnical Manager

Abbreviations/Definitions

ND = Non Detect (Values only known to be somewhere between zero and the reporting limit.)

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Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide TestsDate Submitted: 3/28/2022 Client #: 58251(jw1704) ^{-230 SA} # Samples Submitted 2Client Name: Dovetail Bio Energy Consultant: Shane EagleAddress: PO Box 249 Delaware, OH 43015 Sampled By: Shane Eagle**Office Use**

Form #: _____ Due Date: _____

No. Samples Rec'd: _____

Date Rec'd: _____

Rec'd By: _____

Check box if data is to be: ☐ Fax # _____☒ e-mail: (address) dave.ellis@azuraassociates.com

Soil Audit Format:	ppm: <input type="checkbox"/> yes <input type="checkbox"/> no		Report unit: pick one: <input type="checkbox"/> lb/ac <input type="checkbox"/> lbs/1000 sq. ft. <input type="checkbox"/> kg/ha			Sample Depth: <input type="checkbox"/> inches <input type="checkbox"/> cm				
(16 Characters ea.)	Sample 1 (8 characters ea.)		Sample 2 (8 characters ea.)		Sample 3 (8 characters ea.)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea.)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Lagoon	VE	ZE0329014								
Discharge	VE	ZE0329015								

Please check desired package (Soil): ☐ S001 ☐ S001P ☐ S001A ☐ S001B ☐ S001C ☐ S110 ☐ S113 ☐ S001N ☐ S001AN ☐ S001BN ☐ S001CN☐ S001PN ☐ S002 ☐ S003 ☐ S004 ☐ S004LM ☐ S005 ☐ S006 ☐ S006W=client H2O ☐ S007 ☐ S015 ☐ S015N ☐ S019 ☐ S008 ☐ S009 ☐ S009LM☐ S010 ☐ S011 ☐ S017 ☐ S171 ☐ S180 ☐ S251 (Manure, Fert., Lime): ☐ Z001 ☐ Z002 ☐ Z003 ☐ Z004 ☐ X001 ☐ X002 ☐ X003 ☐ L001 ☐ L002☒ Other EE260

If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.)

3 Day turn around

58251
AEM
4/1/22

FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide Tests
FR0392
Date Submitted: 3/28/22 **Client #:** 58251 **# Samples Submitted** 2

Client Name: Renergy **Consultant:** R.O.

Address: PO Box 249 Delaware, OH 43015 **Sampled By:** R.O.

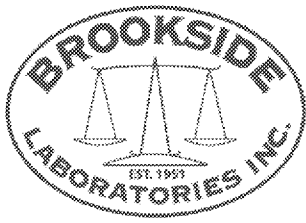
Office Use
 Form #: _____ Due Date: _____
 No. Samples Rec'd: _____
 Date Rec'd: _____
 Rec'd By: _____

Check box if data is to be: ☐ Fax # _____ ☐ e-mail: (address) Fraserfield@renergy.com

Soil Audit Format:	ppm: <input type="checkbox"/> yes <input type="checkbox"/> no		Report unit: pick one: <input type="checkbox"/> lb/ac <input type="checkbox"/> lb/1000 sq. ft. <input type="checkbox"/> kg/ha				Sample Depth: <input type="checkbox"/> inches <input type="checkbox"/> cm			
(16 Characters ea.)	Sample 1 (8 characters ea.)		Sample 2 (8 characters ea.)		Sample 3 (8 characters ea.)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea.)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
EMD DP Discharge 3/28/22	VE	ZE03	3019							
EMD Lagoon NEL 3/28/22	VE	ZE03	30020							

Please check desired package (Soil): ☐ S001 ☐ S001P ☐ S001A ☐ S001B ☐ S001C ☐ S110 ☐ S113 ☐ S001N ☐ S001AN ☐ S001BN ☐ S001CN
☐ S001PN ☐ S002 ☐ S003 ☐ S004 ☐ S004LM ☐ S005 ☐ S006 ☐ S006W=client H2O ☐ S007 ☐ S015 ☐ S015N ☐ S019 ☐ S008 ☐ S009 ☐ S009LM
☐ S010 ☐ S011 ☐ S017 ☐ S171 ☐ S180 ☐ S251 (Manure, Fert., Lime): ☐ Z001 ☐ Z002 ☐ Z003 ☐ Z004 ☐ X001 ☐ X002 ☐ X003 ☐ L001 ☐ L002
☒ Other: EE 260 If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.)

3 pay turn Around



Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected:
Date Received: 04/06/2022

Lab Number: ZE0406012
Location: LAGOON
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed Prep</u>	<u>Anal</u>	<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Apr-08	BLH	0.207 %	0.01
IA490	NITROGEN-NITRATE		300.0		Apr-07	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Apr-08	JK	0.207 %	0.01
IA590	pH		9045D		Apr-06	LMP	6.32 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Apr-07	Apr-07	ALP	507.6 mg/kg	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Apr-06	LMP	1.0008 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Apr-07	LMP	2.025 %	0.01
IB200	POTASSIUM	3050B	6010C	Apr-07	Apr-07	ALP	447.8 mg/kg	5

Approval

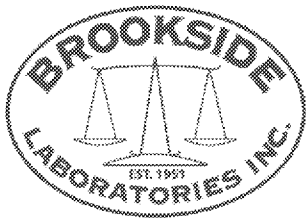
Erica Huber
Environmental & Geotechnical Manager

Abbreviations/Definitions

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Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.



Brookside Laboratories, Inc.
Analytical Report

200 White Mountain Drive
New Bremen, OH 45869
Phone: (419) 977-2766
Fax: (419) 977-2767

Client Number: 58251
Client Name: Renergy, Inc.
Consultant Name: Brookside Consultants of Ohio, Inc.
Date Collected:
Date Received: 04/06/2022

Lab Number: ZE0406013
Location: DISCHARGE
Description:
Sub Description:

<u>Code</u>	<u>Procedure Name</u>	<u>Prep Method</u>	<u>Analysis Method</u>	<u>Completed Prep</u>	<u>Anal</u>	<u>Analyst</u>	<u>Result</u>	<u>LOQ</u>
IA465	NITROGEN- AMMONIA (EPA 350.1)		350.1		Apr-08	BLH	0.265 %	0.01
IA490	NITROGEN-NITRATE		300.0		Apr-07	BAT	ND %	0.0001
IA510	NITROGEN-TOTAL KJELDAHL (TKN)		351.2 M		Apr-08	JK	0.292 %	0.01
IA590	pH		9045D		Apr-06	LMP	7.89 SU	0.01
IA640	PHOSPHORUS-TOTAL (ICP)	3050B	6010C	Apr-07	Apr-07	ALP	942.4 mg/kg	50
IA710	SPECIFIC GRAVITY		SM 2710 F		Apr-06	LMP	.99322 g/ml	
IA860	TOTAL SOLIDS		SM2540 G		Apr-07	LMP	2.678 %	0.01
IB200	POTASSIUM	3050B	6010C	Apr-07	Apr-07	ALP	699.1 mg/kg	5

Approval

Erica Huber
Environmental & Geotechnical Manager

Abbreviations/Definitions

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Detected = Compound was detected between zero and the Limit of Quantitation. Limits detected below the LOQ can not be quantitated.

FIELD WORKSHEET For: All Soil, Manure, Fertilizer, Lime, Herbicide/Pesticide TestsDate Submitted: 4/2022 Client #: 58251(jw1705) # 235 Samples Submitted 2Client Name: Dovetail Bio Energy Consultant: Shane EagleAddress: PO Box 249 Delaware, OH 43015 Sampled By: Shane Eagle

Office Use	
Form #:	Due Date:
No. Samples Rec'd:	
Date Rec'd:	
Rec'd By:	

Check box if data is to be: ☐ Fax # ☒ e-mail: (address) dave.ellis@azuraassociates.com

Soil Audit Format:	ppm: <input type="checkbox"/> yes <input type="checkbox"/> no	Report unit: pick one: <input type="checkbox"/> lb/ac <input type="checkbox"/> lbs/1000 sq. ft. <input type="checkbox"/> kg/ha		Sample Depth: <input type="checkbox"/> inches <input type="checkbox"/> cm						
(16 Characters ea.)	Sample 1 (8 characters ea.)		Sample 2 (8 characters ea.)		Sample 3 (8 characters ea.)		Sample 4 (8 characters ea.)		Sample 5 (8 characters ea.)	
Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Lagoon		ZEO406012								
Discharge		ZEO406013								

Bottles not labelled

Please check desired package (Soil): ☐ S001 ☐ S001P ☐ S001A ☐ S001B ☐ S001C ☐ S110 ☐ S113 ☐ S001N ☐ S001AN ☐ S001BN ☐ S001CN☐ S001PN ☐ S002 ☐ S003 ☐ S004 ☐ S004LM ☐ S005 ☐ S006 ☐ S006W=client H2O ☐ S007 ☐ S015 ☐ S015N ☐ S019 ☐ S008 ☐ S009 ☐ S009LM☐ S010 ☐ S011 ☐ S017 ☐ S171 ☐ S180 ☐ S251 (Manure, Fert., Lime): ☐ Z001 ☐ Z002 ☐ Z003 ☐ Z004 ☐ X001 ☐ X002 ☐ X003 ☐ L001 ☐ L002☒ Other EE260

If other tests are required on certain samples, note the samples below and specify the test by index code. (See backside.)

3 Day turn around